

*On the Dark Poles and Bright Equatorial Belt of the First
Satellite of Jupiter.* By E. E. Barnard, M.A.

It will, perhaps, be remembered that on 1890 September 8, while observing the transit of the first satellite of *Jupiter* with the 12-inch equatorial, the satellite appeared as a dusky elongated spot projected on a bright region of *Jupiter*. With a high power it appeared distinctly double, on a line nearly vertical to the belts of *Jupiter*. I called Mr. Burnham's attention to it, and we both saw it thus for upwards of half an hour. Subsequently it was seen several times when crossing a dark portion of the planet as a bright, very elongated spot, but the elongation in these cases was nearly parallel to the belts of *Jupiter*. Yet when closely examined on the sky it always appeared perfectly round.

An account of these observations will be found in *Monthly Notices*, vol. li., No. 9. To explain these singular peculiarities I at that time offered two theories: the first of these was that the satellite was itself possibly double. This idea has long since been abandoned because of its improbability. The second theory supposed the satellite to be surrounded with a white equatorial belt, and that its poles were dark or dusky, and that it rotated on an axis nearly perpendicular to its orbit. If such were the case, when the satellite crossed a bright portion of the planet the white belt would cut it apparently in two, as it would be equal in brightness to the surface of *Jupiter*, and thus leave the two dark polar caps as two separate spots nearly perpendicular to the belts of *Jupiter*, and would thus give the observed appearance of duplicity.

If, however, the satellite should happen to be projected on a dark belt, then the dark poles would merge into the surface of *Jupiter*, and the white equatorial belt alone would be visible as an elongated white spot nearly parallel to the belts of *Jupiter*.

It was not until this year (1893) that an opportunity occurred to settle this question with the 36-inch.

On September 25 last the transit of this satellite was watched with the great telescope. It first appeared as an elongated white spot, east and west, when over the dusky region near the planet's limb, and later it appeared as two dusky spots in a line north and south, exactly as it appeared in the 12-inch 1890 September 8. But during moments of good definition it was seen distinctly as a small round disc, dusky at the poles, and with a white belt between them.

On November 11 it was again observed under nearly similar conditions, and presented the same phenomena.

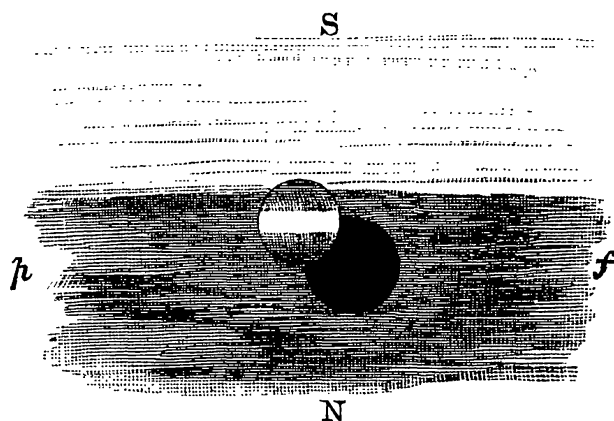
The best view of these dark polar caps and bright belt was had on November 19, with a power of 1,000 diameters on the great telescope, and almost perfect seeing.

At this transit the satellite partly obscured its own shadow on the south preceding side, and was partly projected on the southern edge of the south equatorial belt, and partly on the bright region beyond.

With the fine seeing the satellite presented a beautiful appearance. It stood out in bold relief like a little globe. The polar caps were heavily marked and quite dark, while the bright belt was very conspicuous.

The observation was perfectly satisfactory, and the second theory had become a fact.

I send a careful drawing of the appearance of the satellite on this date, which will give a good idea of the phenomenon. The shadow was larger than the satellite.



Transit of Satellite I., 1893 Nov. 19; 36-in. Refractor.

We have here established the discovery made 1890 September 8 with the 12-inch telescope, that this little attendant on *Jupiter* has distinct polar caps that are dusky like those of *Jupiter*, and that it has a bright equatorial belt, as bright as the brightest portion of *Jupiter's* surface. The conclusion is uncontestable, therefore, that the satellite also rotates on an axis nearly perpendicular to its orbit, as *Jupiter* itself does.

From the fact that the bright belt is not always exactly parallel to those on *Jupiter*, and the line between the polar caps is not always exactly perpendicular to the belts of *Jupiter*, there must be a slight inclination of the axis of rotation of the satellite. From the fact also that the south cap is sometimes apparently a little smaller than the northern one, its axis is probably tipped away from us at its southern end. It is also probably tilted towards the west by a few degrees. From peculiarities in the appearance of the belt, it is probable that the period of rotation on this axis is not coincident with the satellite's period of revolution about *Jupiter*.

I have data in my hands now that will after a few more observations, perhaps, settle the inclination of the axis, and probably give us the period of rotation.

I think the presence of these dusky poles and bright belt would rather imply that this satellite at least is in a physical condition not vastly different from that of *Jupiter* itself.

Mount Hamilton, California:
1893 November 27.

Photograph of the Nebulæ H I 56 and 57 Leonis.
By Isaac Roberts, D.Sc., F.R.S.

The photograph of the nebulae H I 56 and 57 *Leonis*, R.A. $9^h 26^m$, Decl. $21^\circ 59'$ north, was taken with the 20-inch reflector on 1893, April 4, with exposure of the plate during 4 hours, and is enlarged to the scale of 1 millimètre to 24 seconds of arc.

The nebulae are Nos. 2903 and 2905 in the *New General Catalogue*, and 1861–1863 in the *General Catalogue*.

No. 1861 is described by Sir J. Herschel (*General Catalogue*, p. 79) as considerably bright, very large, extended, gradually much brighter in the middle, resolved; *s. p.* of 2. No. 1863 is described as very faint, considerably large, round, pretty suddenly brighter in the middle, resolved; *n. f.* of 2. These nebulae are figured in the *Phil. Trans.*, 1833, Pl. XV., fig. 70, p. 495, but the drawing does not at all resemble the photograph.

Lord Rosse (*Observations of Nebulae and Clusters of Stars*, pp. 76, 77, and Pl. III., fig. 9, 1851) gives the results of thirty observations of the nebula made between the years 1846 and 1878. A drawing is also given in the *Phil. Trans.* for 1850, Pl. XXXVI., fig. 3. The drawing, which was made in the year 1851, is in its outlines very fairly in agreement with the photograph, but of course the details of the extensions and condensations of the nebulous matter are not as shown on the photograph.

The photograph shows the nebula to be a symmetrical spiral, with great extensions of very faint nebulosity on the north and south sides. The nucleus is stellar in the centre of the convolutions of the spiral, which, owing to perspective effects, are elongated so as to appear of an elliptical form in nearly north and south directions. The convolutions of the spirals are broken up into nebulous star-like patches with faint nebulosity between them. On the negative the faint nebulosity is seen to extend further to the north and to the south than is shown on the print which is now presented.

The nebula H II 260 is also shown on the photograph $2^m 45^s$ following, and 13 minutes of arc north. It has a stellar nucleus resembling two faint stars surrounded by very faint nebulous rings.

It will be observed that the stars in the region of these nebulae are pretty numerous.